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RESEARCH ARTICLE

Understanding Equilibrium Impairments In Hemiplegic Stroke: A Prevalence-Based Approach

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ABSTRACT

Objective: Hemiplegic stroke patients often face challenges in maintaining postural control, which significantly affects their recovery, balance, and quality of life. Postural control deficits can persist even in patients with good balance scores on standardised tests, highlighting the importance of specific assessment tools.The purpose of this study was to determine how useful the Postural Assessment Scale for Stroke (PASS) is for evaluating postural control in stroke patients who have suffered hemiplegia. **Methods**: A cross-sectional investigation was carried outusing the PASS to assess static and dynamic postures in 25 acute and subacute hemiplegic stroke patients. Statistical analysis was performed to examine correlations between age, gender, and postural control. **Findings**: This study found a strong negative correlation between age and postural control, with older patients exhibiting poorer postural control. Gender differences were not statistically significant. The mean PASS score was 21.76, indicating significant challenges in postural control among the patients. **Novelty**: This study highlights the PASS's potential in rehabilitation settings for tailored, individualized care plans by demonstrating its predictive value for postural control in hemiplegic stroke patients.

Keywords: Hemiplegic Stroke; Postural Control; PASS; Balance

1 INTRODUCTION

Hemiplegic stroke patients face significant challenges in their recovery and daily functioning. These individuals experience paralysis or weakness on one side of their body, which can severely impact their mobility, balance, and overall quality of life. Postural control, which is a critical aspect of functional recovery, affects the Capacity to carry out everyday tasks and maintain independence. Stroke survivors often experience significant challenges in maintaining balance and stability, which may result in a lower quality of life and a higher risk of falls[1,2]. Postural control deficits may persist even in patients with good functional balance scores on assessments that are standardized, like the Berg Balance Scale, suggesting that these tests may not fully capture the nuances of postural dysfunction[3].

70–85% of initial strokes are hemiplegic strokes., leading to substantial motor impairments (Raghuveer et al., 2024). Research has shown that patients with hemiplegic stroke often struggle with various aspects of motor control, including sit-to-stand performance, gait, and upper limb function[4,5]. Postural instability is prevalent, with significant differences in stability indices between patients with hemiplegia and healthy controls[6]. Postural control is influenced by multiple factors including age, cognitive load, sensory disturbances, and the specific nature of stroke lesions[7]. Postural control is particularly affected by cognitive impairment. According to studies, stroke survivors who experience cognitive impairment have poorer balance and a higher chance of falling than those who do not[8]. This highlights the importance of cognitive resources in maintaining postural control, especially during complex tasks, such as turning around or sitting down. It is crucial to investigate postural control in hemiplegic stroke patients, as it significantly affects rehabilitation outcomes and quality of life.

The Postural Assessment Scale for Stroke (PASS) plays a crucial role in evaluating and enhancing postural control in hemiplegic stroke patients. This scale not only measures balance, but also predicts functionality across different recovery stages, making it an essential tool in rehabilitation

settings. The PASS has demonstrated strong predictive validity for functionality in stroke patients, with R^2 values ranging from 0.54 to 0.87 across acute, subacute, and chronic stages[9]. Cut-off scores on the PASS can effectively classify patients' functional levels, aiding tailored rehabilitation strategies[9]. This study set out to determine the significance of the Postural Assessment Scale for Stroke (PASS) in assessing postural control in hemiplegic stroke patients.

2 MATERIALS AND METHODS

Twenty-five hemiplegic stroke patients participated in a cross-sectional study to evaluate their postural control in Krupanidhi College of Physiotherapy and other hospitals in Bangalore over a 6-month period. The patients were selected using convenience sampling, and ethical approval and informed consent were obtained. The inclusion criteria were acute and sub-acute stroke patients aged 40-60 years with unilateral ischaemic stroke confirmed by CT or MRI, a Mini-A score of 24 or above on the Mental State Examination (MMSE) and the capacity to stand and sit unaided for 30 seconds. The exclusion criteria included lower limb amputation, bilateral limb weakness, unstable vital signs, significant cognitive impairment (MMSE score < 23), or history of other neurological or orthopaedic conditions affecting balance.

Static and dynamic postures were assessed using 12 items on the Postural Assessment Scale for Stroke (PASS). was used to assess postural control. The overall score was between 0 and 36, and the assessment takes approximately 10 minutes. The required sample size of 25 patients was determined using sample size estimation formulas with 95% confidence level and 85% power. The tools used for measurement included a 50 cm high examination table, stopwatch, ruler, and step.

Statistical Analysis

SPSS version 29.0 was used to analyze the data. The demographic and outcome variables' descriptive statistics (mean and standard deviation) were computed.Pearson's correlation was used to assess the relationship between age and the total PASS score, whereas gender differences in postural stability were assessed using the Mann-Whitney U test.

3 RESULTS

The mean age of the patients was 50.08 ± 6.99 years and the mean Body Mass Index (BMI) of the patients was 23.44±4.63. Seventeen patients (68%) were male, and 8 (32%) were female, with a male predominance. With respect to mental state and posture, the mean Mini-Mental State Examination (MMSE) score was 25.76±1.39, indicating that most patients had normal cognitive function. The mean score for static posture was 8.20±2.27, and the mean score for dynamic posture was 13.16± 2.05, respectively. The mean Postural Assessment Scale for Stroke (PASS) score was 21.76±3.99, reflecting the postural control abilities of the patients (Table 1).

Table 1: Demographic details, mental status and postural control of the study participants

Demographic details	**Mean ± SD**
Age (yrs.)	50.08 ± 6.99
BMI	23.44 ± 4.63
Gender	**n (%)**
Male	17 (68%)
Female	8 (32%)
Characters	**Mean ± SD**
MMSE	25.76 ± 1.39
Static posture	8.20 ± 2.27
Dynamic posture	13.16 ± 2.05
PASS score	21.76 ± 3.99

A significant negative correlation was found between age and the overall PASS score, as indicated by the Pearson's correlation coefficient of -0.82 and p-value of 0.001. This suggests that, as age increased, the total PASS score decreased, reflecting a decline in postural control. With respect to gender differences in postural stability, the Mann-Whitney U test was used to assess differences in the total PASS scores between males and females. The test yielded a U value of 42.00, Z score of 195.00, and p-value of 0.128The p-value showed that the genders' differences in postural stability were not statistically significant (Table 2).

Table 2: Correlation between age and total PASS score and gender differences in postural stability among study participants

Correlation	**R**	**P**	
Pearson's correlation	-0.82	0.001*	
The difference in the gender in PASS score	**Mann Whitney 'U' test**		
	U	**Z**	**P**
Gender Vs Total PASS score	42.00	195.00	0.128

U'=Mann Whitney test value; Z-tests statistics; P-probability

4 DISCUSSION

The patients, predominantly male with a mean age of 50.08 years, exhibited normal cognitive function as indicated by a mean MMSE score of 25.76. The male predominance (68%) is consistent with previous studies on stroke patients[10,11]. The mean MMSE score of 25.76 suggests that most patients had normal cognitive abilities, which contrasts with Huang et al., who found that 40.37% of older adult stroke survivors had cognitive impairment, and Qu et al., who reported an even higher prevalence of 80.97% for post-stroke cognitive impairment (PSCI)[10,11]. These differences may be attributed

to the older populations in these studies.

The findings revealed relatively low static and dynamic posture scores, with a mean Postural Assessment Scale for Stroke score of 21.76, indicating significant postural control challenges. Previous studies have shown that the prevalence of postural disorders in stroke patients is often linked to spatial neglect and body orientation issues[12]. Postural control is frequently compromised owing to weight-bearing asymmetry and delayed muscle recruitment[12,13]. In this context, the present study identified a strong negative correlation between age and total PASS score, suggesting that older patients exhibited poorer postural control.

Pearson's correlation coefficient ($p = 0.001$) was -0.82 highlights that increased age correlates with decreased postural control, aligning with the existing literature that indicates aging exacerbates postural instability in hemiplegic patients[14]. Older individuals often experience greater postural changes due to factors such as hypokinesia and loss of flexibility, which are more pronounced in patients with hemiplegia[14]. However, the current investigation found no statistically significant variations in postural stability between genders. According to Puszczalowska-Lizis et al., men and women differed in their postural stability among older participants, especially when there were no visual signals present[15]. However, the Mann-Whitney U test results ($U = 42.00$, $p = 0.128$) in the present study indicated no significant gender differences in postural stability, in contrast to studies suggesting variations in postural control based on gender[16]. This lack of a significant difference may reflect the complex interplay of factors influencing postural control beyond gender alone.

The use of the PASS to assess postural control was consistent with previous research. The PASS is a reliable and valid tool for assessing postural abilities in stroke patients, demonstrating good construct and predictive validity, and high internal consistency[17]. This supports the choice of the PASS as an appropriate measure in the current study. These results emphasize how important postural control is for hemiplegic individuals, but it is important to consider other factors, such as spatial neglect and rehabilitation interventions, which may significantly affect postural stability[16].

Postural control is often overlooked compared with limb impairment. However, this is crucial for functional mobility[13]. Effective rehabilitation must include exercises aimed at improving the trunk stability and core muscle strength[13]. Neurodevelopmental Therapy (NDT) has shown promise for enhancing postural control and overall rehabilitation outcomes[18]. Balance training, particularly using systems such as the Biodex Balance System, has been effective in reducing postural instability[6]. Implementing PASS in rehabilitation can enhance targeted kinesiotherapeutic approaches, facilitating better outcomes in postural control and reducing fall risk[19,20]. The limited sample size of this study is one of its limitations, which could have an impact on how broadly applicable the findings are. Additionally, this study excluded people in the chronic stage of stroke, which may provide important information about long-term postural control, and only included stroke patients in the acute and subacute stages.

5 CONCLUSION

This study demonstrated that postural control significantly affects hemiplegic stroke patient's quality of life and recovery, with age and cognitive impairment playing key roles in postural stability. PASS proved to be a reliable tool for assessing postural control in these patients. Rehabilitation strategies focusing on trunk stability exercises and balance training are crucial for enhancing postural control and lowering the incidence of falls during stroke recovery.

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